

APPLICATION NO. 10/626366

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Claim 1 (canceled).

Claim 2 (currently amended): The BGA package of claim 1 [[1]], further including a third conductive ring arranged around the die attachment region and positioned at a closer distance to the die attachment region than the first and second power rings.

Claim 3 (original): The BGA package of claim 2, wherein the third conductive ring is a ground ring.

Claim 4 (original): The BGA package of claim 3, wherein the ground ring is formed of a plurality of spaced apart conductive ground ring segments, at least some of the ground ring segments being independently grounded.

Claim 5 (currently amended): The BGA package of claim 2 [[1]], wherein each of the first ring segments of the first power ring and each of the second ring segments of the second power ring comprise separate power sources.

Claim 6 (currently amended): The BGA package of claim 2 [[1]], wherein the plurality of spaced apart conductive first ring segments are arranged in staggered configuration relative to the plurality of spaced apart conductive second ring segments.

Claim 7 (currently amended): ~~The BGA package of claim 6,~~ A BGA package,
which comprises:

a substrate having a front side and a back side;

a die attachment region formed on the front side of the substrate;

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an electrically conductive first power ring that includes a plurality of spaced apart conductive first ring segments formed on the front side of the substrate, the first ring segments being arranged around the die attachment region;

an electrically conductive second power ring that includes a plurality of spaced apart conductive second ring segments formed on the front side of the substrate, the second ring segments being arranged around the die attachment region and positioned at a greater distance from the die attachment region than the first ring segments;

a plurality of vias penetrating through the substrate, including: a subgroup of first vias which are connected to the first ring segments of the first power ring; and a subgroup of second vias which are connected to the second ring segments of the second power ring;

a semiconductor die mounted over the die attachment region on the front side of the substrate, the semiconductor chip having a plurality of bond pads;

bonding wires for connecting the plurality of bond pads of the die to associated first ring segments and second ring segments;

wherein the each of the first ring segments includes a conductive tab that electrically connects the first ring segments to at least some of the first vias; and

wherein the conductive tabs of the first ring segments are arranged so that they pass through spaces between the plurality of spaced apart conductive second ring segments.

Claim 8 (currently amended): The BGA package of claim 7 ~~[[6]]~~, wherein the each of the first ring segments is connected to at least two of the first vias.

Claim 9 (currently amended): The BGA package of claim 8, wherein the each of the first ring segments includes a conductive tab that electrically connects each first ring segment to an associated one of the ~~[[the]]~~ first vias; and

wherein the conductive tabs of the first ring segments are arranged so that they pass through spaces between the plurality of spaced apart conductive second ring segments.

Claim 10 (currently amended): The BGA package of claim 8, wherein the first ring segments of the first power ring are longer ~~larger~~ than the second ring segments of the second power ring.

Claim 11 (currently amended): A BGA package as in Claim 7 [[1]] further including an encapsulation layer which protectively encases the front side of the substrate encasing at least a portion of the semiconductor die and the bonding wires; and

a plurality of solder balls formed on the back side of the substrate, at least some of the solder balls being electrically connected to the vias.

Claim 12 (currently amended): A BGA package as in Claim 7 [[1]] wherein the first power ring includes sixteen (16) spaced apart conductive first ring segments; and wherein the second power ring includes sixteen (16) spaced apart conductive second ring segments.

Claim 13 (currently amended): A BGA package as in Claim 7 [[1]] wherein the first power ring includes twenty four (24) spaced apart conductive first ring segments; and

wherein the second power ring includes twenty (20) spaced apart conductive second ring segments.

CLAIM 14 (CANCELLED)

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Claim 15 (canceled).

Claim 16 (currently amended): The BGA package of claim 18 ~~[[15]]~~, wherein at least some of the first ring segments and the second ring segments provide independent power sources to electronic systems contained within the die.

Claim 17 (currently amended): The BGA package of claim 18 ~~[[16]]~~, wherein the plurality of spaced apart conductive first ring segments are arranged in staggered configuration relative to the plurality of spaced apart conductive second ring segments.

Claim 18 (currently amended): ~~The BGA package of claim 17,~~ A BGA package, which comprises:

- a substrate having an integrated circuit die mounted on the front side of the substrate;

- an electrically conductive first power ring that includes a plurality of spaced apart conductive first ring segments formed on the front side of the substrate around the die;

- an electrically conductive second power ring that includes a plurality of spaced apart conductive second ring segments formed on the front side of the substrate, the second ring segments also being arranged around the die;

- an electrically conductive ground ring formed on the front side of the substrate around the die;

- a plurality of vias penetrating through the substrate, including: a subgroup of first vias which are connected to the first ring segments of the first power ring; a subgroup of second vias which are connected to the second ring segments of the second power ring; and a subgroup of ground vias which are connected to the ground ring;

- bonding wires for connecting the die to the first ring segments, second ring segments, and ground ring;

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wherein the each of the first ring segments includes a conductive tab that electrically connects the first ring segments to at least some of the first vias; and

wherein the conductive tabs of the first ring segments are arranged so that they pass through spaces between the plurality of spaced apart conductive second ring segments.

Claim 19 (currently amended): The BGA package of claim 18 [[15]], wherein the ground ring is formed of a plurality of spaced apart conductive ground ring segments, at least some of the ground ring segments being independently grounded.

Claim 20 (currently amended): The BGA package of claim 18 [[15]], wherein at least a portion of the die and bonding wires are contained within an encapsulant.

Claim 21 (new): A BGA substrate, which comprises:

- a substrate having a die attachment region formed on a front side of the substrate;

- an electrically conductive first power ring that includes a plurality of spaced apart conductive first ring segments formed on the front side of the substrate, the first ring segments being arranged around the die attachment region;

- an electrically conductive second power ring that includes a plurality of spaced apart conductive second ring segments formed on the front side of the substrate, the second ring segments being arranged around the die attachment region and positioned at a greater distance from the die attachment region than the first ring segments;

- a plurality of vias penetrating through the substrate, including:

- a subgroup of first vias which are connected to the first ring segments of the first power ring; and

- a subgroup of second vias which are connected to the second ring segments of the second power ring;

- each of the first ring segments includes a conductive tab that electrically connects the first ring segments to at least some of the first vias; and

- the conductive tabs of the first ring segments are arranged so that they pass through spaces between the plurality of spaced apart conductive second ring segments.

Claim 22 (new): The BGA package of claim 21, further including a third conductive ring arranged around the die attachment region and positioned at a closer distance to the die attachment region than the first and second power rings.

Claim 23 (new): The BGA package of claim 22, wherein the third conductive ring is a ground ring.

Claim 24 (new): The BGA package of claim 23, wherein the ground ring is formed of a plurality of spaced apart conductive ground ring segments, at least some of the ground ring segments being independently grounded.

Claim 25 (new): The BGA package of claim 21, wherein each of the first ring segments of the first power ring and each of the second ring segments of the second power ring comprise separate power sources.

Claim 26 (new): The BGA package of claim 21, wherein the each of the first ring segments is connected to at least two of the first vias.

Claim 27 (new): A BGA package as in Claim 21 further including a plurality of solder balls formed on the back side of the substrate, at least some of the solder balls being electrically connected to the vias.

Claim 28 (new): A BGA package as in Claim 21 wherein the first power ring includes sixteen (16) spaced apart conductive first ring segments; and
wherein the second power ring includes sixteen (16) spaced apart conductive second ring segments.

Claim 29 (new): A BGA package as in Claim 21 wherein the first power ring includes twenty four (24) spaced apart conductive first ring segments; and
wherein the second power ring includes twenty (20) spaced apart conductive second ring segments.

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